Training observers

L. A. Beard
Department of Zoology, University of Queensland, Queensland 4072

ABSTRACT

From a large data base on observer training gathered over 20 years of South Australian kangaroo survey (SAKS), it was estimated that approximately 40–48 hours in the air (including both survey and transport time) were required to train and calibrate a new observer. Training consisted of learning to see a consistent proportion of the population and calibrating this proportion against a "standard" trained observer. On a first survey flight, an untrained observer, even with prior ground survey experience, always saw fewer kangaroos than a trained observer. Proper training of observers is mandatory if aerial surveys for kangaroos are to continue to improve and remain a respected method of estimating kangaroo populations.

INTRODUCTION

Aerial survey estimates of population density and distribution start with the raw numbers counted by observers. Many factors, including environmental variables and survey design, influence the accuracy and repeatability of these estimates. Ultimately, however, any improvements in accuracy and repeatability of these estimates will be limited by the variability in the observers themselves, hence the need for training to minimize this variability.

When first developing aerial survey for kangaroos about 25 years ago, Graeme Caughley recognized the need for observers to be suitably trained. He estimated that approximately 50 hours total flying time was necessary for a naïve observer to learn to see kangaroos reliably and consistently from the air. The reasons for training include generally:

- learning to work in a confined space for long periods
- learning to work in a hot and stuffy or cold and windy environment
- learning to work in bumpy, turbulent conditions without feeling ill
- learning to feel confident in a small aircraft, or a helicopter with the door off
- learning to concentrate for long periods at a consistent level.

And specifically

- developing a search image for kangaroos from the air
- learning to distinguish different species of kangaroo from the air
- developing a consistent and workable search pattern. This includes learning to mentally adjust the viewing strip in turbulent or strong cross-wind conditions (see Grigg *et al.* 1999) and knowing where to look in relation to the sun.
- establishing the new observer's "calibration" level against a "standard" observer. (Experience has shown that most successful trainees reach a consistent level of approximately 100% of the trained observer's counts i.e., they all see the same proportion of the total population, even though they may not see exactly the same individual kangaroos.)

This paper draws on experience from 20 years of annual survey in the South Australian Pastoral Zone, during which the training of a number of observers has been attempted with varying success. All successfully trained observers so far used on the surveys have been assessed directly against Graeme Caughley (i.e., once removed), or twice removed from this standard (against L. Beard) (Table 1). The following data pertains to trainees, most of whom have been "calibrated" against the same trained observer (L. Beard).

METHODS

Trainee observers were seated in the front right (passenger) seat of a 4-seater Cessna, counting a strip transect identical to that counted by the trained observer sitting, in tandem, in the right rear seat. Commonality of strip was confirmed by checks between observer and trainee on the position of various features such as roads and fences in relation to the counting strip.

When first starting, trainees were advised to count for only five units (about nine minutes) at a time, then rest for five units and so on, gradually working up to continuous counting. Records were kept, in all sessions (each of 3.5–4 h total flying time), of red and grey kangaroos seen by the trainee, as a percentage of the trained observer's tallies.

Table 1. Observers used on South Australian kangaroo surveys (1978–1997). Number of surveys are shown in parentheses.

Standard	Once removed	Twice removed
G. Caughley (2)	G. Ross (2)	T. Pople (6)
	P. Harlow (3)	P. Alexander (13)
	L. Beard (16)	M. Fletcher (3)
	J. Caughley (1)	T. Gerschwitz (6)
	D. Grice (3)	

Red and grey kangaroos were added together for the purposes of comparison because:

(a) initially at least, misidentification of species could mask the real trends of total animals seen, and

(b) usually there were not enough grey kangaroos seen to make any meaningful progressive comparisons.

Training, however, for successful observers, was still extended in almost all cases beyond the number of sessions after which a trainee would normally be considered "calibrated". The extra sessions were in areas of locally high grey kangaroo density and allowed further familiarity with, and assessment of calibration for, grey kangaroos. Thus, the quality of data on assessment of these trainees is higher than would otherwise be available. Sessions where the trained observer saw less than approximately one animal per unit (i.e., <1 animal km^{-2}) were eliminated from the assessment.

RESULTS

According to Graeme Caughley (pers. comm.), based on a mixture of theory and experience, a "training" graph would be expected to look like Figure 1. The number of kangaroos seen by the trainee as a percentage of those seen by the trained observer, would start at about 50%, increase towards 100% as the trainee develops the skills listed above, and probably overshoot this level as the trainee tries "too hard" (possibly counting the odd tree stump) before settling back to a sustainable level of concentration resulting in a consistent percentage. Our results, however, were less clear-cut.

Figure 2 shows trainees who were trained successfully, and one unsuccessful candidate. The learning curve was not as steep as anticipated and started at 60–70%. This may be because all of these trainees were not naïve (i.e., they had prior experience seeing kangaroos on the ground). The oscillations, when a consistent percentage was reached, straddled 100%, but the variability was greater than expected. This is not surprising considering that the standard observer against which the trainee is assessed may not be completely consistent in his/her observations either.

Figure 3 shows six trainees who were either unsuccessful or are still being assessed. Note that the learning curves are somewhat steeper,

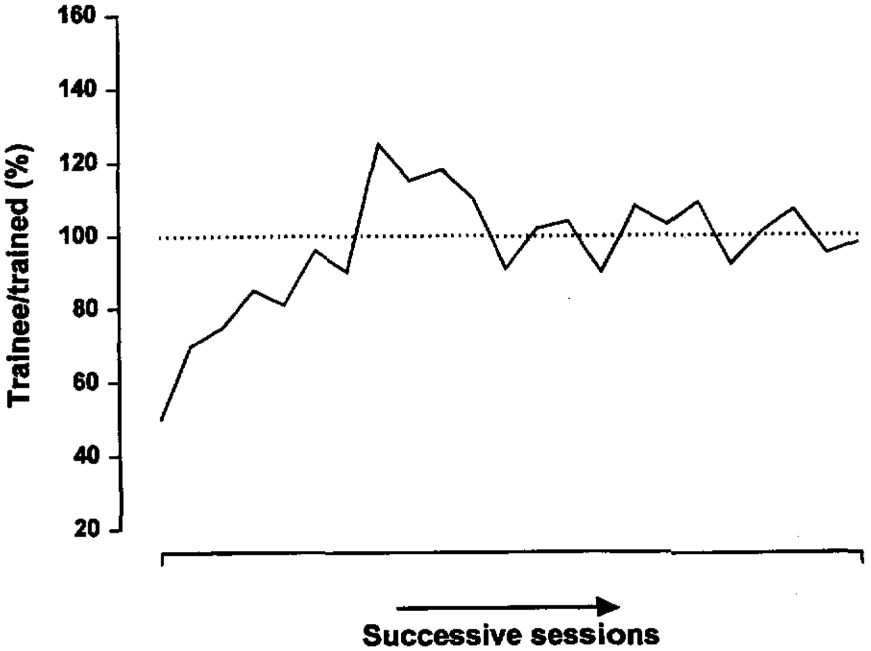

Figure 1. Theoretical graph showing the course of training for a new observer. Initial trainee counts are about 50% of those of a trained observer, increase to, and often overshoot 100% as the trainee tries "too hard", then settle back to a consistent level as a percentage of trained observer counts, usually 100%.

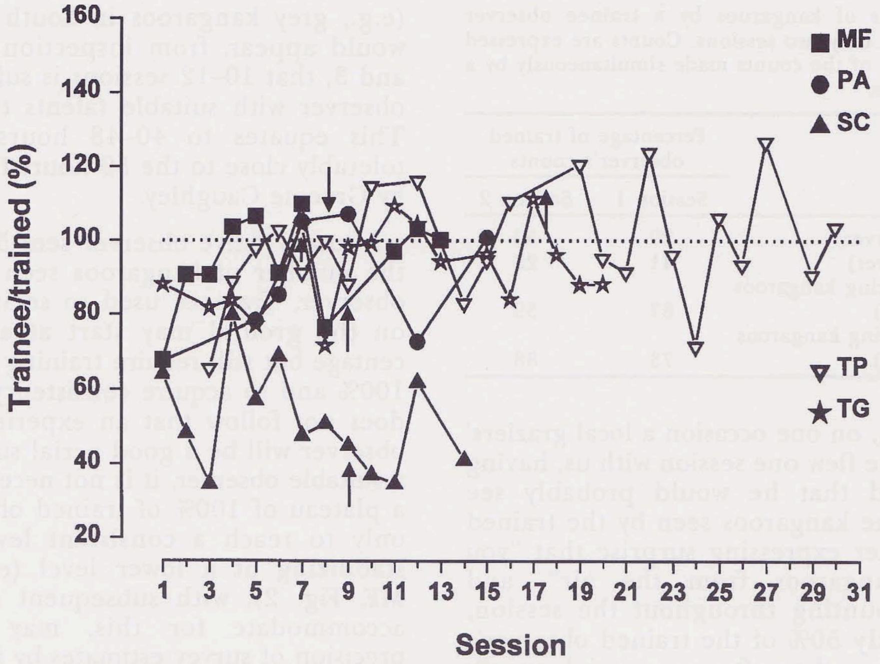

Figure 2. Training graphs for four successful trainees and one unsuitable trainee (SC). Arrows indicate when resumption of training occurred after a year's break. (Surveys, and therefore training opportunities, are conducted annually.)

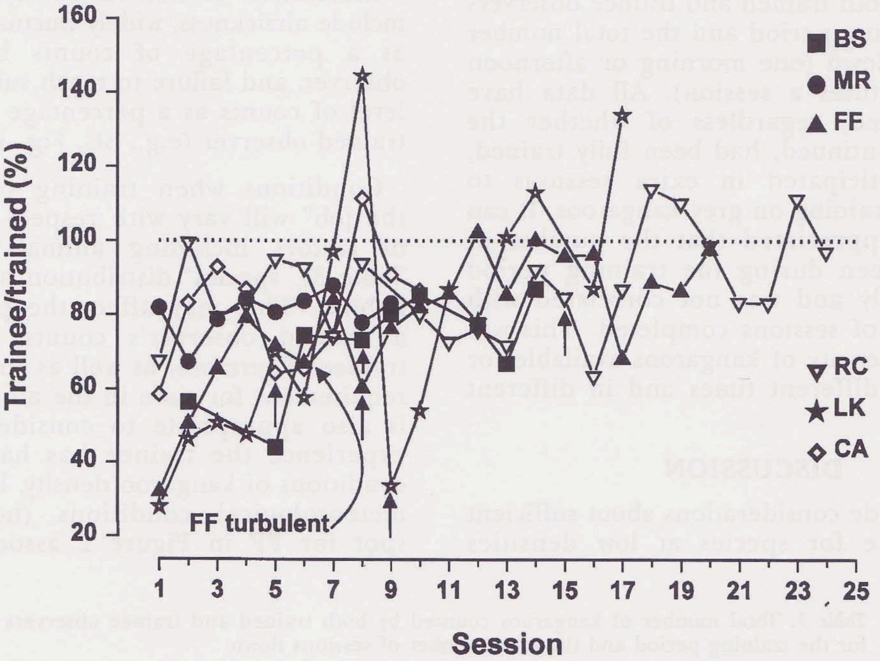

Figure 3. Training graphs for six partly trained or unsuccessful trainees. Arrows indicate when resumption of training occurred after a year's break.

starting at a lower percentage (several of these trainees had little or no experience in seeing kangaroos on the ground). Also, the plateaux reached, if any, are generally below 100%.

Note, in both Figures 2 and 3, the arrows indicating when training resumed following a year's break. Most of those in Figure 3 show a dip at this point. This is not the case in Figure 2.

Comparisons between counts of a trained observer and trainee observer participating in only two sessions are given in Table 2. These results reinforce the notion that naïve observers start at a lower percentage than those with some prior experience in observing from the air or, more commonly, counting kangaroos on the ground. However, the latter still initially do not see 100% of what a trained observer sees.

Table 2. Counts of kangaroos by a trainee observer participating in only two sessions. Counts are expressed as a percentage of the counts made simultaneously by a trained observer.

Trainee	Percentage of trained observer's counts	
	Session 1	Session 2
BH (naïve observer)	29	56
JS (naïve observer)	41	23
GR (used to seeing kangaroos on the ground)	87	59
LB (used to seeing kangaroos on the ground)	73	88

In addition, on one occasion a local graziers' representative flew one session with us, having been briefed that he would probably see about half the kangaroos seen by the trained observer. After expressing surprise that "you **can** see kangaroos from the air", and diligently counting throughout the session, he saw **exactly** 50% of the trained observer's total. He was thereafter an aerial survey convert!

Table 3 shows total number of kangaroos counted by both trained and trainee observers for the training period and the total number of sessions flown (one morning or afternoon flight constitutes a session). All data have been included, regardless of whether the trainee discontinued, had been fully trained, or had participated in extra sessions to consolidate training on grey kangaroos. It can be readily appreciated that the number of kangaroos seen during the training period varied greatly and was not correlated with the number of sessions completed. This was due to the density of kangaroos available for counting at different times and in different areas.

DISCUSSION

Leaving aside considerations about sufficient training time for species at low densities (e.g., grey kangaroos in South Australia), it would appear, from inspection of Figures 2 and 3, that 10–12 sessions is sufficient for an observer with suitable talents to be trained. This equates to 40–48 hours in the air, tolerably close to the 50 hours first estimated by Graeme Caughley.

A totally naïve observer sees 50% or less of the number of kangaroos seen by a trained observer. Trainees used to seeing kangaroos on the ground may start at a higher percentage but still require training to increase to 100% and to acquire consistency. However, it does not follow that an experienced ground observer will be a good aerial surveyor. To be a suitable observer, it is not necessary to reach a plateau of 100% of trained observer's tally, only to reach a consistent level. However, stabilizing at a lower level (e.g., 80% for *MF, Fig. 2), with subsequent correction to* accommodate for this, may reduce the precision of survey estimates by increasing the random error associated with larger correction factors.

Indications of non-suitability of observers include airsickness, widely fluctuating numbers as a percentage of counts by a trained observer, and failure to reach sufficiently high level of counts as a percentage of those of a trained observer (e.g., SC, Fig. 1).

Conditions when training observers "on the job" will vary with respect to a number of factors including animal density (see Table 3), species' distribution and quality of habitat. This may affect the proportion of a trained observer's counts seen by the trainee. Therefore, as well as some minimum requirement for time in the air being met, it is also appropriate to consider how much experience the trainee has had in varying conditions of kangaroo density, light intensity, meteorological conditions (note the low spot for FF in Figure 2 associated with a

Table 3. Total number of kangaroos counted by both trained and trainee observers for the training period and the total number of sessions flown.

Trainee	Kangaroos counted by trainee observer	Kangaroos counted by trained observer	No. of sessions	Outcome
MF	3 974	4 292	13	Training complete
PA	1 774	2 040	16	Training complete
SC	1 182	2 226	14	Training discontinued
TP	5 538	5 741	31	Training complete
BS	1 517	2 096	15	Training discontinued
TG	5 476	5 709	20	Training complete
MR	3 136	4 030	10	Training discontinued
FF	4 070	4 969	20	Undecided
RC	7 881	8 814	24	Undecided
LK	3 709	4 582	19	Undecided
CA	1 729	2 108	11	Training incomplete

"turbulent" session) and habitat (or "visual noise").

An alternative method for monitoring trainee progress may be to keep tallies of trainee counts as a percentage of calibrated observer count in increments of, say, 50, rather than session by session. This would allow the inclusion of sessions where the density of kangaroos was very low and would mean that the time taken to train an observer would be more dependent on the density of kangaroos in the training area. However, it must be noted that kangaroos are easier to see at higher densities and it is the time spent in training which is likely to influence a trainee's counts more than simply the number of animals counted.

The number of animals seen, even by an experienced, calibrated observer, may vary as a percentage of actual numbers present although we have no data on the extent to which this occurs. Discrepancies between a trainee and calibrated observer's tallies may be amplified accordingly. Repeatability and, to a lesser extent, accuracy of aerial survey estimates, can no doubt be improved by further standardizing parameters for trained observers, such as limiting counting time per session and limiting number of sessions per week, to minimize fatigue. Large sample sizes will also reduce the influence of individual variation over time.

As indicated in Figure 3, there may also be a need for a short "warm-up" session at the beginning of each survey, at least after a break of several months or years.

It is difficult to predict beforehand who may be a suitable observer. Over the 20 years of SAKS there have been eight successful observers trained and four failures, with three as yet unfinished or undecided. The failure rate of 33% means a trainee is never guaranteed to become a fully calibrated observer.

The South Australian survey data base on observer trainees is probably the largest of its kind and shows conclusively that **any** untrained observer, when put into an aerial survey situation for the first time, will see fewer kangaroos than a trained observer no matter how much other experience he or she may have had on the ground, or even in the air counting other species.

Even the line transect method, which is supposedly less affected by observer training, will not have its central assumption met (i.e., that all animals directly on the survey line are counted) with an untrained observer. This is quite apart from any problems of misidentification by an untrained observer. For aerial survey to remain a respected and recognized form of population estimation of kangaroos and to allow for further refinements in accuracy and repeatability of these estimates (e.g., correction factors) the process has to start with a properly trained observer.

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